

How Resilient is Mortgage Credit Supply? Evidence from the COVID-19 Pandemic

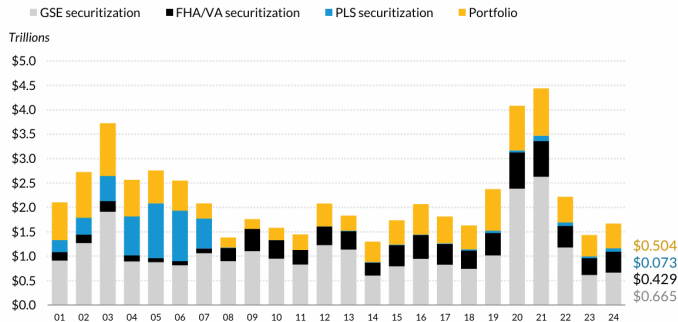
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Baruch Real Estate seminar
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Views expressed here are those of the authors and do not necessarily reflect the opinions of the Federal Reserve Board, Federal Reserve Bank of Philadelphia, Federal Reserve Bank of Boston, or the Federal Reserve System.

The mortgage market boomed during the pandemic ...

- 2020-21 was a remarkable period for the US mortgage market:
 - >**\$4tr** of originations in each of these two years, a new record (despite COVID)
 - 30-year fixed rate fell below **3%** for first time
 - Surge in profits for lenders (e.g., Rocket: \$9.4bn in 2020; up 950%)

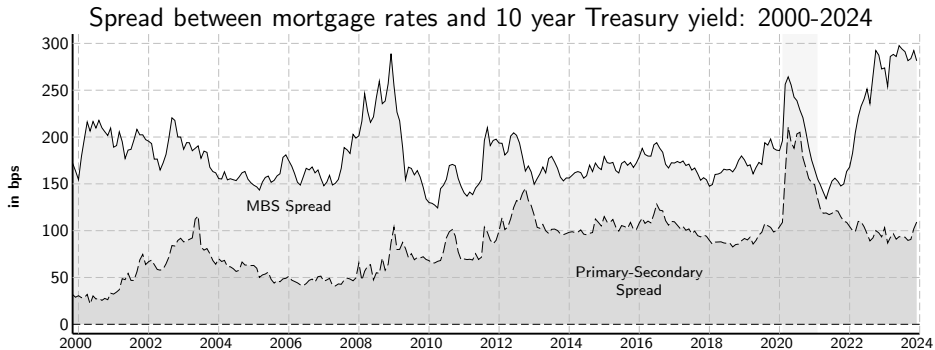


Sources: Inside Mortgage Finance and the Urban Institute.

Note: Data as of Q4 2024.

... but also showed signs of dysfunction (e.g., incomplete passthrough)

- Spread between mortgage rate and 10yr Tsy spiked by up to 80-90bp in 2020
 - Driven by historically high level of “primary-secondary spread” (more shortly)
 - Also signs of tighter credit supply outside prime segment (e.g., jumbo, FHA)



Today: Study 2020-21 “stress test” and draw out broader lessons

Broad research question: How resilient and elastic is mortgage credit supply?

- Does mortgage credit respond elastically to large demand shocks?
 - Has technology relaxed capacity constraints over time?
 - How do capacity constraints work? Local or national?
- Have nonbanks made credit supply more fragile? (now originate 2/3 of loans)
 - Financed by short-term debt; liquidity crunch at start of pandemic
- Do government interventions support supply?
 - Credit guarantees – do they fully insulate against credit risk?
 - Quantitative easing

Why should we care? Monetary transmission; housing mkt cycles; mortgage design etc.

Preview: five broader lessons

1. Mortgage market still faces binding capacity constraints in periods of peak demand
 - Technology has not significantly relaxed constraints (e.g., fintechs did not gain share)
2. Capacity constraints today operate nationally, not locally (geographic integration)
 - Key constraint is *aggregate* industry resources
3. Nonbanks expanded lending *more* elastically than banks; less fragile than believed?
 - But remain reliant on government-sponsored securitization (evidence: jumbo market)
4. Government guarantees insulated lending, but not sufficient in risky FHA segment
5. Fed QE had “local” effects on mortgage supply. (Identification: TBA mkt)

Related literature

- **Determinants of mortgage supply & pricing**
 - **Capacity constraints:** Fuster et al. (2024,2013); Choi et al. (2022); Frazier-Goodstein (2023); Sharpe and Sherlund (2016)
 - **Competition:** Scharfstein & Sunderam (2017); Buchak and Jorring (2021)
 - **Securitization:** Calem, Covas & Wu (2013)
 - **Government guarantees:** Hurst et al. (2016)
 - **Shocks to intermediaries:** Drechsler et al. (2024); Ramcharan et al. (2014); Mondragon (2015)
 - **Fed MBS purchases (“QE”):** Di Maggio et al. (2020); Krishnamurthy and Vissing-Jorgensen (2011)
 - **Agency MBS pricing:** e.g. Boyarchenko, Fuster & Lucca (2019)
- **Frictions in interest rate passthrough and refinancing:** Di Maggio et al. (2017); Beraja et al. (2019); Berger et al. (2020); Amromin, Bhutta & Keys (2020).
- **Nonbank mortgage lenders and fragility:** Buchak et al. (2024); Buchak et al. (2018); Kim et al. (2018); Jiang (2020); Jiang et al. (2020).
- **COVID and consumer credit markets:** An et al. (2021); Cherry et al. (2021); Agarwal et al. (2021); Bracke et al. (2020); Horvath, Kay and Wix (2020); Iverson et al. (2020)

Data

- Optimal Blue: platform that processes $\approx 1/3$ of U.S. mortgage originations
 - Rate locks. Lock-level information including note rate, net points/rebates, date/time-stamp, loan characteristics, location, lender/branch ID.
 - Offer rates (“OB Insight”). Note rates and net rebates offered by lenders for menu of different mortgage contracts (held fixed over time). 20 cities.
- J.P. Morgan Markets: MBS prices, yields, OAS, option cost.
- SitusAMC: Values of mortgage servicing rights.
- MBA Quarterly Performance Report: Lender income and costs.
- HMDA: Loan-level originations; market characteristics (e.g., concentration).
- Nonbank Call reports: quarterly financial data on nonbanks.
- eMBS: Loan-level + security-level data on mortgages in agency pools.
- McDash: Composition of mortgage originations.
- Others: Freddie Mac Primary Mortgage Market Survey; NY Times COVID Github; Google trends; Ahrefs: Shopping etc.

Roadmap

1. Intermediation markups in 2020-21
 - What explains high mtg-Tsy spread? Comparison to other episodes?
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 - “Local” effects of mortgage QE (exploit features of TBA mkt)

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Decomposition of mortgage-treasury spread

$$FRM_{30yr} - UST_{10yr} = \underbrace{FRM_{30yr} - MBS \text{ yield}}_{\text{primary-secondary spread}} + \underbrace{MBS \text{ yield} - UST_{10yr}}_{\text{MBS yield spread}}$$

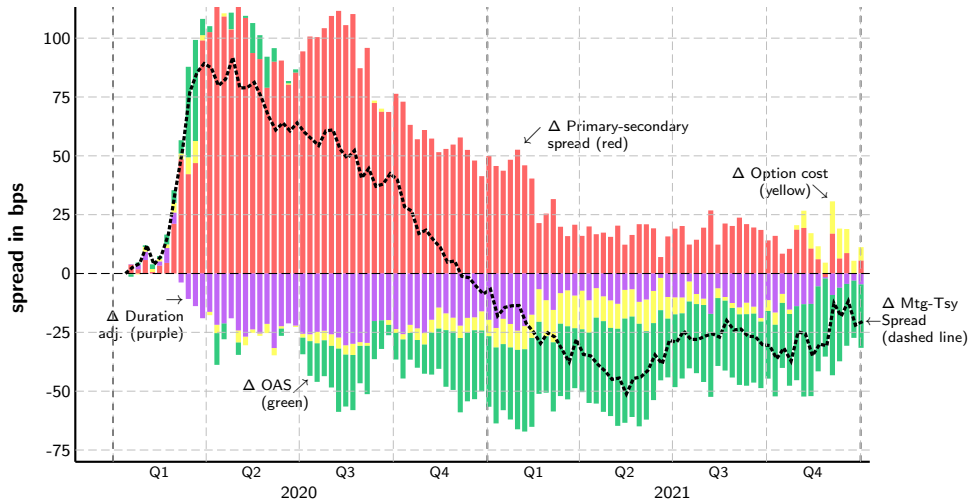
where *MBS yield* is the yield corresponding to new production MBS
(with coupon = $FRM_{30yr} - 59\text{bp g-fee} - 25\text{bp servicing fee}$)

The second term can be further decomposed into:

$$MBS \text{ yield} - UST_{10yr} \approx \underbrace{\left(UST_{dur} - UST_{10yr} \right)}_{\text{duration adjustment}} + \text{Option Cost} + \text{Option-Adjusted Spread (OAS)}$$

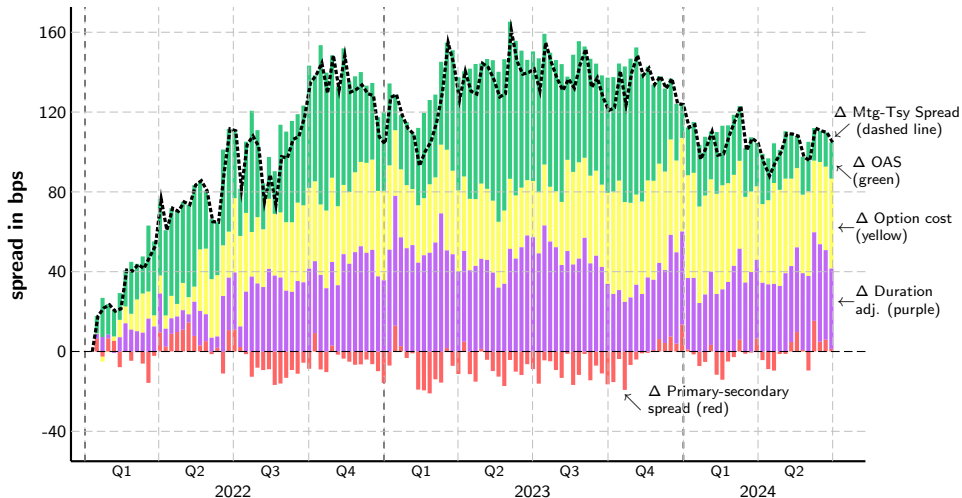
Decomposition of mortgage-treasury spread in 2020-21

High mortgage rate due to primary-secondary spread: 120bp (peak); 10-20bp (mid-21)



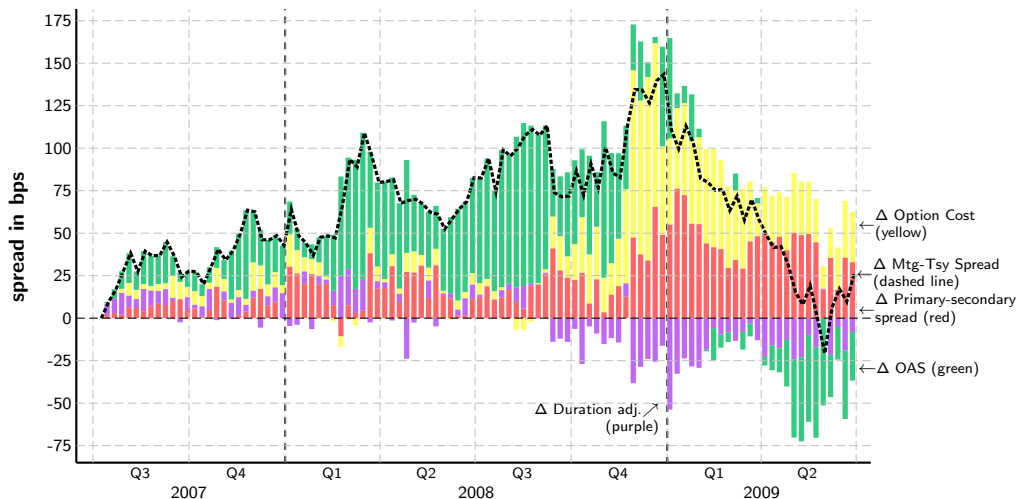
Contrast to 2022-24 monetary tightening

High mortgage rates due to rate volatility; end of QE (see also Drechsler et al. 2024)



Contrast to 2007-09 financial crisis

In 2007-09, high mortgage rates due to MBS mkt dislocation, not primary market



Gain-on-sale: alternative measure of price of intermediation

Net gain from originating mortgage, then securitizing it and selling servicing rights

→ Direct markup (Fuster et al. 2017); reflects PV of primary-secondary spread.

$$\text{gain-on-sale}_{r_m} = \underbrace{p_{MBS}^{r_m - g - s} - \text{fee}_{GSE}}_{\substack{\text{mortgage value ex servicing rights} \\ \text{(net of upfront \& flow g-fees)}}} + \underbrace{(s \times m)}_{\substack{\text{value of} \\ \text{servicing} \\ \text{rights}}} - \underbrace{(100 - \text{points})}_{\substack{\text{net amount} \\ \text{paid to borrower}}}$$

- To compute gain-on-sale:
 - MBS prices (p_{MBS}): J.P. Morgan Markets (TBA market)
 - servicing multiples (m): SitusAMC (based on secondary market trades etc.)
 - mtg rates r_m & points: Freddie Mac PMMS, MBA or Optimal Blue Insight

Gain-on-sale also increased sharply in 2020-21...

- Increase in gain-on-sale $\approx$ 150-250bp. Direct measure of lender markup.
 - Given $>$ \$3tr originations in Q2-Q4, we estimate total gain-on-sale of \$171bn, or **\$80bn additional income for lenders** relative to gain-on-sale at 2.5%

Gain-on-Sale

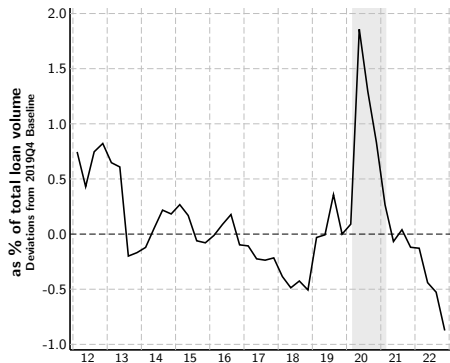


Primary-Secondary Spread



...and two other measures also show sharp rise in intermediation markup

Profitability from SEC Filings



Production Income from MBA



Punchline: Very sharp rise in intermediation markup in 2020-21. Limited the passthrough of low rates to mortgage borrowers.

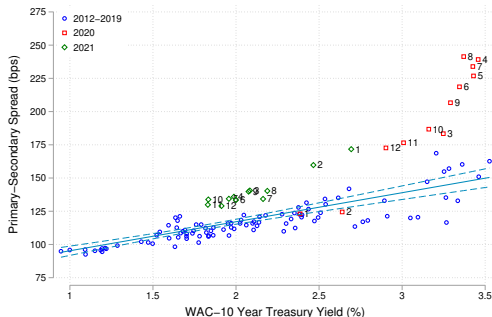
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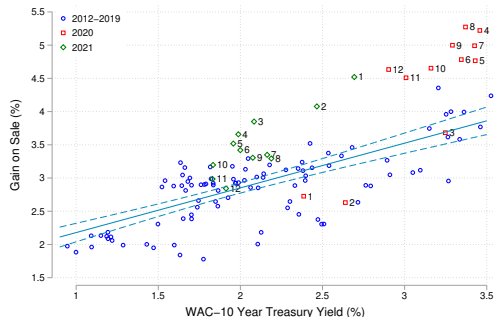
High markup only partially explained by high level of demand

- “Price of intermediation” typically rises during refinancing booms
 - Supply not perfectly elastic due to capacity constraints (Fuster et al. 2024)
- But historic slope explains only 20-40% of 20-21 spike: supply unusually *inelastic*
 - Particularly surprising given growth of online/digital lending technologies (more later)

Prim.-sec. spread vs refi incentive



Gain-on-Sale vs refi incentive



Operational & labor mkt frictions contributed to inelastic supply

1. Labor market frictions:

- Practitioners say hard to train & monitor new mtg employees due to remote work
- Preference for experienced, well-trusted hires (often poached from competitors)

2. Licensing:

- New loan officers (or moving across banks / states) must be licensed through NMLS
- Most testing and fingerprinting locations closed in first phase of pandemic

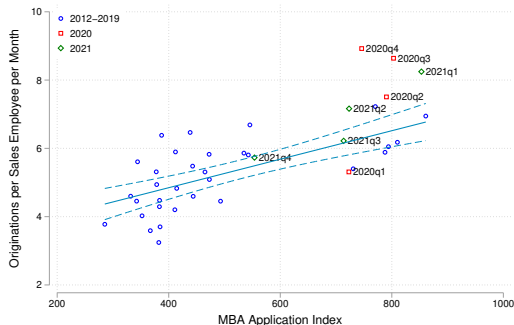
3. Practical challenges in originating and closing loans:

- Hard to document borrower employment & income (e.g., many firms shut or remote)
- County recorder offices closed or on limited schedules
- Property appraisals, notarized closing etc. more difficult due to social distancing

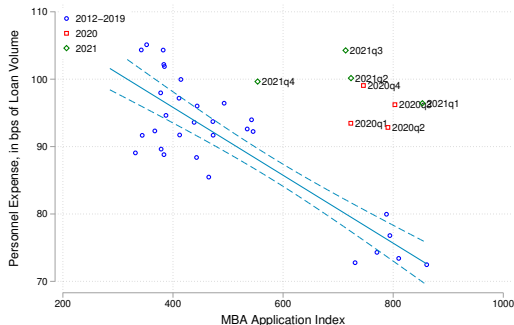
Effects: Quantity and cost of labor

Tests of inelastic labor supply: (i) high labor capacity utilization; (ii) high price of labor

Originations Per Sales Employee



Labor Costs (Sales Employees)



Effects: Loan officer licensing and job postings

- Right panel: project mortgage loan officer (MLO) licensing volume (from NMLS) by regressing $\log(\text{licenses})$ on lags of $\log(\text{applications})$ using pre-2020 data
→ Sharp drop in licensing activity in 2020 despite rise in applications

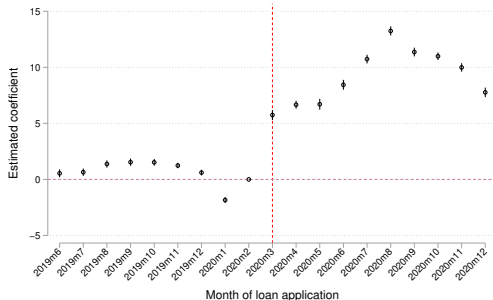


Effects: Delays in loan closing

- Method: Regress processing time or dummy for delay in loan closing on loan characteristics and vector of time dummies.

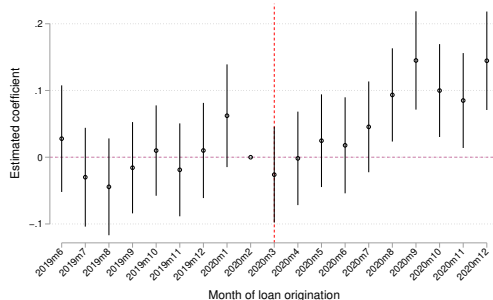
→ *Finding*: Sharp increase in loan delays after pandemic begins

HMDA: Processing Times (days)



Processing time winsorized at 1% level. Pre-pandemic mean is 48.0 days.

NSMO: Delay in Loan Closing (0/1)



Pre-pandemic mean of dependent variable is 0.287

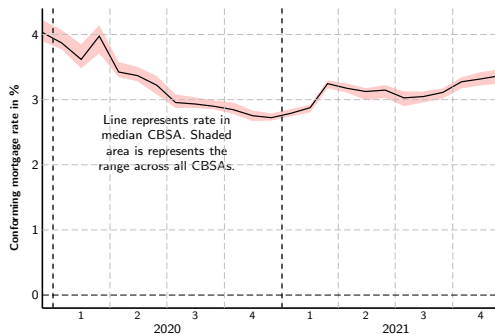
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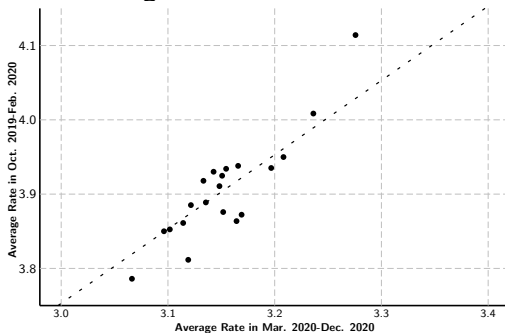
Cross-sectional dispersion in interest rates

- Strikingly — mortgage rates evolved very similarly across the country in 2020-21.
- Why not more dispersion due to local variation in capacity constraints?

Mortgage Rates across CBSAs



Mortgage Rates by CBSA Averaged Over Different Periods

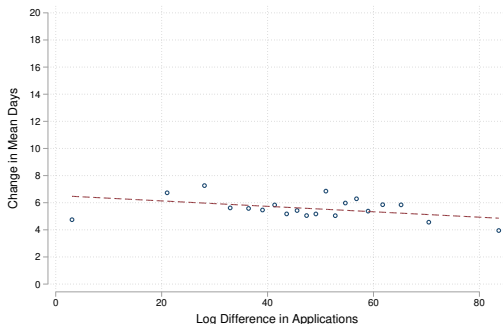


Additional evidence: uniform increase in processing times

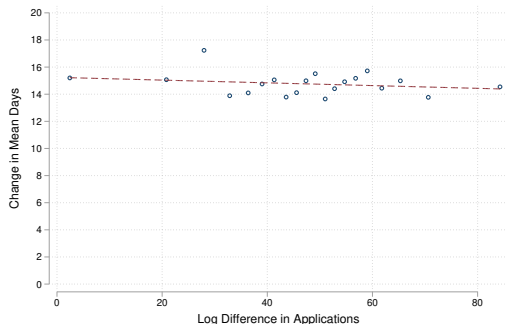
- Similarly: big slowdown in processing speeds (esp. refinancings) — but *no relation* between speed and local demand growth!

→ Note: Proc time = diff between application and action date in cHMDA

Purchase mortgage processing time



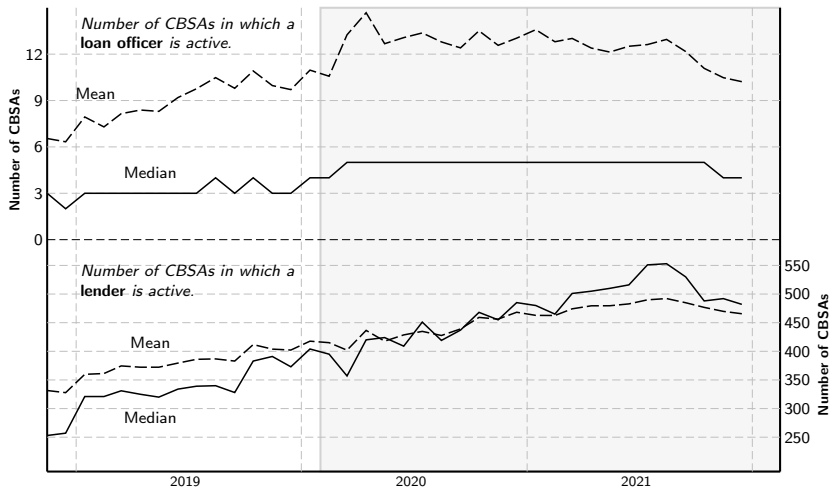
Refinance processing time



Our explanation: Capacity constraints today are national in scope

- Examples of geographic integration:
 - i. Top two lenders (Rocket, UWM) active in 50 states without local labor mkt presence
 - ii. Standard for lenders to centralize underwriting/processing in regional or national hubs (e.g., for Wells Fargo: Des Moines and Minneapolis)
- Evidence: in HMDA, compute geographic scope for lenders and loan officers (LOs)
 - Measure: in how many CBSAs was lender/LO active in same calendar month?
- Findings (see paper for regression evidence):
 1. Lenders / LOs geographically diversified even pre-COVID: (i) Lender on average active in 250-300 CBSAs; (ii) individual LO: 9 CBSAs
 2. Lenders/LOs expand to new markets as demand grows. Geographic dispersion:
 - (i.) increases with lender/LO application volume, and
 - (ii.) increased during COVID relative to pre-pandemic

Graphical evidence of high/rising geographic dispersion



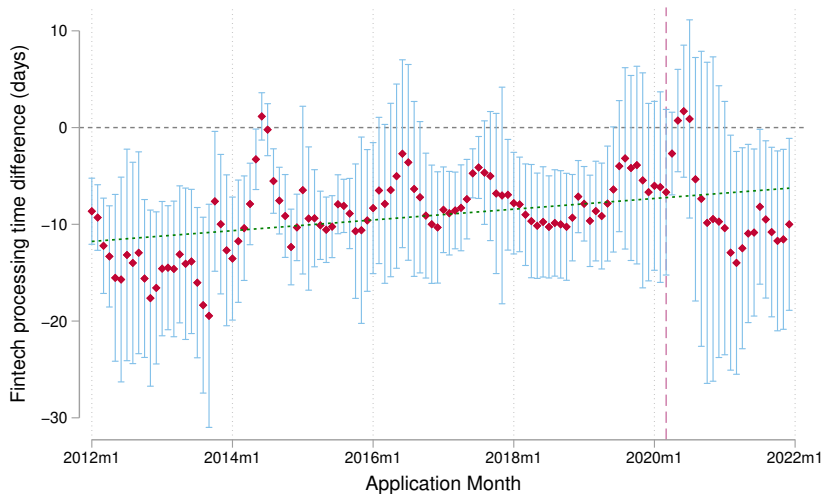
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Has technology alleviated capacity constraints?

- Rapid growth of online/digital lending technologies in years just prior to COVID
 - Online lending rare up to the mid-2010s (Buchak et al. 2018; Fuster et al. 2019)
 - But by 2020, 91% of lenders offered digital applications via online portal (ICE, 2021).
- Has this technological change made credit supply more elastic?
 - Low elasticity in 2020-21 suggests not, but perhaps benefits of technology overwhelmed by operational frictions?
- Sharper test: examine performance of technology-based lenders (e.g., Rocket)
 - Did fintech lenders gain market share? Less affected by slower processing speeds?
 - Use fintech classification in Jagtiani et al. (2021), which builds on Buchak et al. (2018) and Fuster et al. (2019).
 - Compare to other nonbanks (similar regulation/funding).

Fintechs retain processing time advantage over other nonbanks...



Slope of Trend Line = 0.046

... but little/no evidence that fintechs expanded lending more elastically

	=100 if lender is fintech; 0 otherwise				Processing time (days)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Pandemic	2.65*** (0.15)	1.64*** (0.17)	0.01 (0.14)	-0.18 (0.15)	10.12*** (0.13)	9.20*** (0.15)	9.31*** (0.15)
Pandemic $\times$ FICO<680				2.85*** (0.19)			
Fintech					-9.38*** (0.28)	-5.64*** (0.28)	-6.78*** (0.25)
Pandemic $\times$ Fintech					0.85*** (0.23)	1.77*** (0.21)	1.88*** (0.22)
Num obs.	13,209,832	7,762,129	7,761,406	7,761,406	13,209,832	7,762,129	7,761,406
Mean of dep. var.	16.06	27.34	27.34	27.34	54.65	50.70	50.69
Lenders	All	Nonbank	Nonbank	Nonbank	All	Nonbank	Nonbank
Loan controls	N	N	Y	Y	N	N	Y

Punchline: Technology has not yet “solved” problem of capacity constraints – remaining bottlenecks (e.g., due to regulation?)

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Credit supply, financial constraints and the role of nonbanks

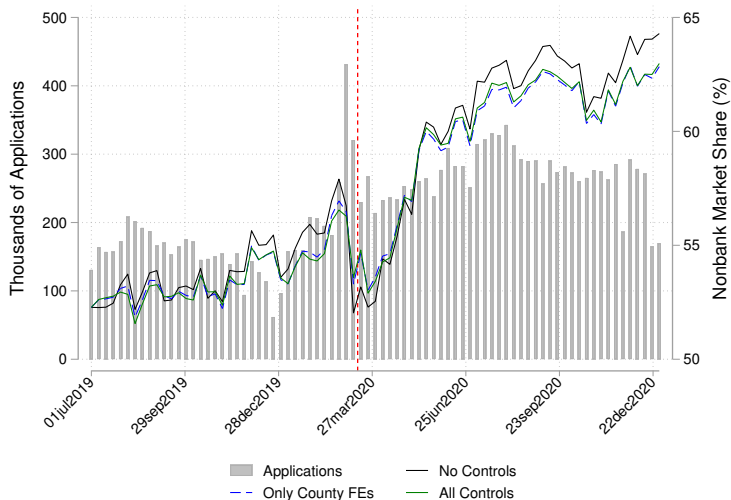
- Nonbanks originate majority of mortgages in recent years (Buchak et al., 2018)
 - Fragile: reliance on short-term warehouse lines from banks (Kim et al. 2018).
 - Half of all nonbanks failed or exited in years around 2008 crisis (Pence 2022)
- Nonbanks faced significant liquidity strains at onset of the pandemic (Pence 2022)
 - Sharp rise in nonpayment due to forbearance: nonbanks required to fund advances
 - Large margin calls on TBA hedges of mortgages in pipeline
- But ultimately, no wave of nonbank failures (Loewenstein 2021). Why?
 - Govt agencies adjusted policies in April/May 2020: e.g., caps on advances; PTAP.
 - Refinancing wave provided “float” of liquidity + higher net income for nonbanks

Did financial frictions facing nonbanks contribute to tighter credit supply?

- Empirical tests:
 1. Did overall lending share of nonbanks fall as pandemic took hold?
 2. Were nonbanks with low liquidity/capital more affected?
- Match confidential-use HMDA data to nonbank Call reports from CSBS.
 - Data on size, liquidity (cash/assets), capitalization, profitability, servicing book etc.
 - **Strategy:** Study shifts in lending of different groups of nonbanks (poisson model)
- Nice “stress test” to study financial stability implications of rise of nonbanks
 - Contribute to growing research on nonbanks: Buchak et al. (2022; 2018); Kim et al. (2018); Jiang (2021); Jiang et al. (2020); Kim et al. (2022) etc.

Nonbank share of conforming market

$$nonbank_{it} = \alpha_t + \beta X_{it} + \gamma_c + \varepsilon_{it} \quad (1)$$



Did nonbank financial constraints limit credit supply?

- Temporary dip in nonbank share at onset of pandemic — coinciding with concerns about funding stability
- But thereafter, nonbanks expanded lending significantly *faster* than banks
- Poisson model: Even in early period, dip in lending more connected to “third-party originations” business model than liquidity or capital constraints
- *Caveat:* Resilient nonbank credit supply dependent on government credit guarantees
 - Larger / more persistent decline in nonbank lending in “jumbo” market without government-backed securitization

Alternative explanations: did forbearance & default risk drive up rates?

Default risk may still matter for intermediaries despite government guarantee:

- **Strategy:** Study rates on conforming loans with high vs low credit score
→ Increase in COVID delinquency/forbearance much larger for low-FICO mortgages.

a. Optimal Blue mortgage rate locks data:

$$\text{rate}_{ilmt} = \alpha_{mt} + \delta_{lt} + \beta_t \times \text{FICO bin}_i + \Gamma X_{ilmt} + \varepsilon_{ilmt},$$

b. Optimal Blue Insight [offer rates: 680 vs 750 credit score]:

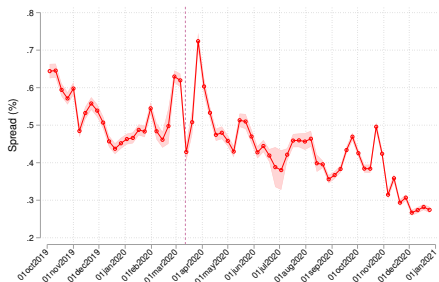
$$\text{rate}_{imt} = \alpha_{mt} + \beta_t \times (\text{FICO}_i = 680) + \varepsilon_{imt},$$

- **Test:** Higher rate premium on riskier mortgages as nonpayment rises (β_t)
→ Answer: No, for conforming loans (but later: do find effects in FHA market)

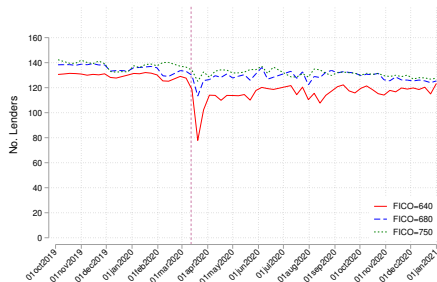
Evidence: Low-FICO loans in the conforming market

- No evidence that lenders withdrew credit supply to riskier conforming borrowers:
 - i. No increase in low-FICO interest rate premium (left chart)
 - ii. Little change in number of lenders offering low-FICO loans (right chart)
 - iii. No drop in share of purchase mtgs to low-FICO borrowers (paper)

Offer Rate Spread: FICO 680 vs 750



Number of Lenders Posting Offers



Other alternative explanations for high markup

- **Macro and health shock?** Direct effects of virus spread on local public health, economic conditions?
 - ⇒ Across MSAs, essentially no link between mortgage rates and (i) measures of “COVID intensity”, and (ii) local unemployment rate changes
- **Market power & shopping?** Lower interest rate passthrough due to mkt concentration (Scharfstein-Sunderam)? Or are borrowers shopping less?
 - ⇒ No variation in rate change across MSAs with more vs. less market concentration;
 - Similar findings using Buchak-Jorring (2021) concentration instrument (crisis failures);
 - ⇒ Concentration actually *decreased* over 2020;
 - ⇒ Online activity suggests that people were shopping *more* than usual

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Role of public support / interventions

- Government plays an important role in the mortgage market, notably:
 - “Agency” securitization with a credit guarantee to lender/investors
 - Fed QE during periods of stress (purchases of agency MBS)
- Can use 2020-21 period to study these effects — examine “riskier” segments outside prime conforming market
 - **Jumbo loans:** does not feature agency securitization (above conforming limit)
 - **Superconforming loans:** less likely to be purchased by investors
 - **FHA loans:** reimbursement of credit losses to servicers is slower / not always complete

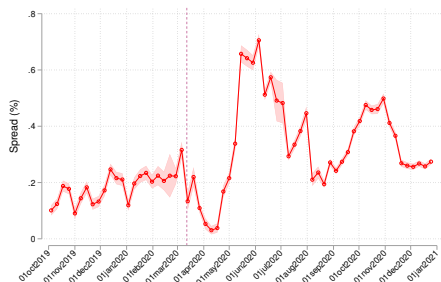
Federal Housing Administration (FHA) market

- FHA mortgages are originated mostly to less creditworthy low-income borrowers & first-time-buyers. LTV generally $>95\%$.
- Government guaranteed. But lender/servicer still exposed to borrower default risk (Kim et al. *BPEA* 2018):
 - **Liquidity risk.** Servicer must advance payments if borrower defaults
 - **Foreclosure costs.** FHA doesn't reimburse everything, slow to pay.
 - **Servicing costs.** Delinquent loans more labor-intensive to service.
 - **Pipeline risk.** Loan may enter forbearance before sale.
- **Finding:** These risks are priced into the mortgage rate. Risk premium increased during height of first wave of pandemic, then recovered.
 - We study wedge between (i) low- vs high-FICO FHA; (ii) FHA vs conforming

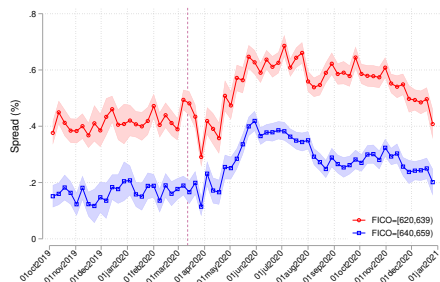
FHA market: Delinquency/forbearance risk priced into mortgage rates

- Higher rates for FHA loans to low-FICO borrowers.
 - **Other evidence:** Many lenders also exit FHA + drop in low FICO share of purchase loans + rise in FHA-conforming rate spread (see paper)

A. Offer rate spread: FICO 640 vs 680



B. Rate lock spread: FICO 640 vs 680



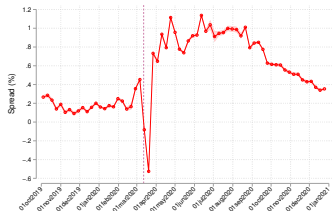
$$\text{rate}_{ilmt} = \alpha_{mt} + \delta_{lt} + \beta_t \times \text{FICO bin}_i + \Gamma X_{ilmt} + \varepsilon_{ilmt},$$

Disentangling effects of government guarantee and QE

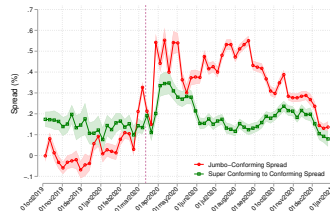
- Conforming vs. jumbo: three differences
 - (1) Government insurance against credit risk
 - (2) Liquid securitization market
 - (3) Fed purchases (March-Dec 2020: net \$675 bn)
- “Super-conforming” loans: above national CLL (510k in 2020); below local CLL. Eligible for guarantees, but low eligibility for Fed purchases.
→ Use to disentangle roles of (1) vs. (2) & (3)
- Super-conforming rates up 15-20bp vs conforming in Apr/May 2020, then revert
- Quantities: study change in loans above vs below thresholds: (i) super-conforming (vs conforming); (ii) jumbo (vs super-conforming); high-cost counties only.
 - Black Knight McDash data (better coverage of jumbos b/c include banks)

Credit supply in jumbo market

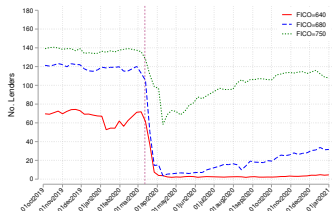
A. Offer rate jumbo-conforming spread



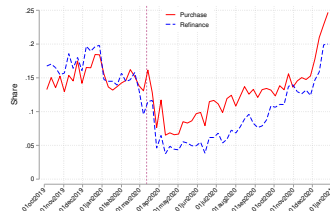
B. Rate lock spreads



C. Number of lenders posting offers



D. Share of jumbo rate locks



Change in jumbo and super-conforming shares

Dependent Variable = 100 if mortgage is above national or local conforming loan limit

	> national CLL (super-conf.)			> local CLL (jumbo)		
	(1)	(2)	(3)	(4)	(5)	(6)
Pandemic	-5.175*** (0.319)	-6.487*** (0.191)	-7.825*** (0.179)	-8.604*** (0.293)	-12.68*** (0.372)	-11.14*** (0.273)
N	152005	325164	492240	99478	133618	242839
Mean Y	35.59	27.02	29.76	20.61	19.38	20.55
Origination type	Purchase	Refinance	All	Purchase	Refinance	All
Loan controls	Y	Y	Y	Y	Y	Y

- Col. 1-3: drop in super-conf. share
 - Col. 4-6: larger drop in jumbo share (>50% in relative terms)
- ⇒ Suggests effects of both QE and government guarantee; larger for the latter

Summing up: five broader lessons

1. Mortgage market still faces binding capacity constraints in periods of peak demand
 - Technology has not significantly relaxed constraints (e.g., fintechs did not gain share)
 - Role for alternative mortgage designs (e.g., Eberly-Krishmanurthy 2014)
2. Capacity constraints today operate nationally, not locally (geographic integration)
 - Key constraint is *aggregate* industry resources
3. Nonbanks expanded lending *more* elastically than banks; less fragile than believed?
 - But remain reliant on government-sponsored securitization (evidence: jumbo market)
4. Government guarantees insulated lending, but not sufficient in risky FHA segment
5. Fed QE had “local” effects on mortgage supply. (Identification: TBA mkt)